REMARKS

The Applicant summarizes the content of the Office Action mailed April 16, 2004 as follows: claims 1-7, 9, 11 and 13-20 stand rejected as obvious under 35 U.S.C. §103(a) over Ikeda (4,567,493) in view of Yaegashi et al. (5,270,370); claims 4-7, 9, 11 and 13-20 stand rejected as obvious under 35 U.S.C. §103(a) over Ikeda (4,567,493) in view of Eida (4,338,611); and claims 8, 10, and 12 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten. The Applicant notes the status of claim 8 as an independent claim and believes it an error for it to be objected-to as dependent upon another claim. Nonetheless, the Applicant believes this claim and all others now stand in an allowable condition, especially in view of the following remarks.

In general, all the Examiner's rejections depend on Ikeda for its teaching of thicknesses for both the resistor and protective layers. Specifically, the Examiner states "Ikeda et al. teaches an . . . ink jet print head comprising:...A resistor layer (207) having . . . a thickness of 10 angstroms . . . A first protective layer (208) . . . having a thickness of 1000 angstroms . . . A third protection layer (210) . . . having a thickness of 100 angstroms . . . ***Thus the thickness of the resistor and the protective layer equals about 1000 angstroms***." (*Bold-Italics Added*)(*Office Action pg. 2-3*). However, adding the value of each of the three ranges gives an actual thickness of 1,110 angstroms, i.e., 10 angstroms (resistor) plus 1000 angstroms (first protective layer) plus 100 angstroms (third protective layer). While the difference between the actual thickness, 1,110 angstroms, and the approximate value used by the Examiner, 1,000 angstroms, may seem negligible, placing these dimensions within the context of the Ikeda patent shows Ikeda as teaching a heater thickness in excess of 1,110 angstroms, not a thickness of about 1,000 angstroms.

From Ikeda's specification, the resistor thickness ranges from 10 to 50,000 angstroms (*Ikeda col. 6:67-68*), the first protective layer thickness ranges from 1,000 to 50,000 angstroms (*Ikeda col. 4:25-26*), and the third protection layer thickness ranges from 100 to 50,000 angstroms (*Ikeda col. 6:12*). Thus, Ikeda teaches an overall thickness ranging from a floor of 1,110 angstroms (10 + 1000 + 100) to a ceiling of 150,000 angstroms (50,000 + 50,000 + 50,000). Ikeda then teaches

preferred ranges that are concentrated well within the floor and ceiling values. (*Ikeda patent col. 4:25-27, 6:9-13, and 6:63-68*). Thus, Ikeda focuses on thickness limitations between the floor and ceiling and the floor and ceiling values constitute extremes in the teaching. Accordingly, nothing in Ikeda would lead one skilled in the art to ranges outside the floor-to-ceiling range, especially beneath the floor limitations since skilled artisans know the difficulty in making extremely thin heater layers.

Since all pending claims have heater thickness limitations in ranges beneath Ikeda's floor limitation, the Applicant submits the patentability thereof. Specifically, all claims cover heater thickness values ranging from 500 angstroms to less than 1,100 angstroms.

Although the Applicant believes this interpretation of the thickness values renders all pending claims allowable, the Applicant further addresses both the Yaegashi and Eida Patents. The Examiner relies on Yaegashi for a teaching "that it is notoriously old and well known in the ink jet [sic] that a heater having an area of 100 to 30,000 sq. microns is a suitable size for providing good discharge characteristics." (*Office Action, page 3*). The heater 2 taught by Yaegashi, however, relates to one for discharging "a normally solid recording material (i.e., a recording material or ink which is solid at room temperature (but can be liquid at an elevated temperature))." *Col. 1, ll. 11-14.* Again, at *col. 5, ll. 31-38*:

> the recording method according to the present invention, a normally solid recording material (ink, i.e, a recording material which is sold at room temperature (5° C. - 35° C) is melted under heating, and the melted recording material is supplied with a heat energy corresponding to given recording data to be ejected through an ejection outlet (orifice) for recording.

Together, these statements lead skilled artisans away from traditional ink jet printers with heaters useful for ejecting ink that is liquid at room temperature. In the Background Section, Yaegashi expressly disparages prior art ink jet printers (Figures

22, 23A-23C, 24A, 24B and 25) that utilize such liquid ink. Among some of the statements, liquid ink is "required to satisfy contradictory properties that they are quickly dried to be fixed on the recording medium but they do not readily plug a nozzle due to drying in the nozzle." *Col. 1, ll. 61-65.* At *col. 2, l. 2, et seq.*:

> [w]hen such inks are used for recording on plain paper, there are encountered several problems such that the inks are not quickly dried to be fixed and the ink image immediately after the printing is liable to be attached to hands on touching and smeared to lower the printing quality.
>
> Further, the ink penetrability remarkably varies depending on the kind of recording paper . . .

Since Ikeda and the present invention teach the liquid inks so remarkably distinguished by Yaegashi, the Applicant respectfully submits the combination of Yaegashi and Ikeda is improper. As the law provides, it is error to find an invention obvious where the prior art references diverge from and teach away from the invention at hand. *W.L. Gore & Assocs. v. Garlock, Inc.* 220 USPQ 303, 311 (Fed. Cir. 1983).

Regarding Eida, the Examiner states "Eida et al. teaches an ink jet print head having a heater made of HfB_2 and an area that ranges from 250 sq. microns (Table 1, example 5) to 400 sq. microns (see Table 1, example 11)." (*Office Action pg. 4*). To obtain these areas from examples 5 and 11, the Applicant presumes the Examiner multiplied dimension "a" by dimension "l." Upon close inspection, however, the Applicant submits that heater area cannot be obtained by multiplying dimension "a" by dimension "l." From the specification, Eida defines "a" as "the length from said orifice to said energy acting zone" (*Eida Patent; col. 3:38-39*) and "l" as "the length of said energy acting zone along the moving direction of the liquid" (*Eida patent; col. 3:37-38*). As clearly depicted in FIG. 1a (below), the lengths "a" and "l" are parallel

line segments. Accordingly, there is no definable area between the two segments and it is impossible for them to define the dimensions of any heater. As a result, Eida does not teach heaters with areas from 250 to 400 sq. microns in examples 5 and 11 or elsewhere.

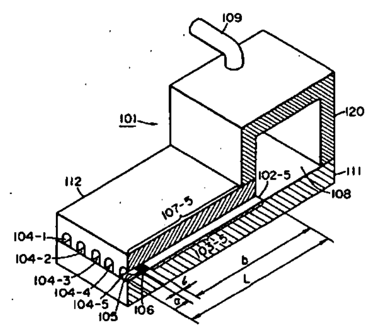

FIG. IA

At *col. 7, ll. 5-6*, Eida does teach area, however, via formation of an electro-thermal transducer 110 with a "rectangular heat energy acting surface 114 of 40 μm x l." At *col. 7, ll. 59*, the parameter "l" ranges from "10 to 800 μm" and TABLE 1 embodies specific examples thereof. As the Examiner points out, Specimen No. 11 teaches a parameter "l" of 10 μm thereby rendering the rectangular heat energy acting surface 114 of an electro-thermal transducer 40 μm x 10 μm, or 400 μm^2. This specimen, however, represents the absolute smallest square micrometer teaching in the entire patent. The Specimen No. 5 cited by the Examiner has an "l" value of 50 μm which would render an area of 40 μm x 50 μm, or 2000 μm^2, not 250 μm^2 as suggested.

Further, beneath TABLE 1, Eida establishes the "Standard for Evaluation" of a specimen as "Extremely good" while lesser performing specimens receive a "Good" (O symbol in TABLE 1) or "Practically satisfactory" (Δ symbol in TABLE 1) rating. From TABLE 1, and based upon the Δ symbols under the "Stability in Droplet Discharging" and "Characteristic in Continuous Droplet Discharging" columns, one skilled in the art recognizes the parameters of Specimen No. 11 constitute a floor beyond which electro-thermal transducers may not stably function. ***Thus, Eida exclusively teaches electro-thermal transducers having square micrometer areas of***

400 or greater.

Since all pending claims recite a heater area of less than 400 micrometers squared, the Applicant submits the patentability of all claims, especially those rejected as obvious variants of the combined teachings of Ikeda and Eida.

Finally, absolutely nothing in Ikeda, Eida or Yaegashi would lead one skilled in the art to a stable microjoule range for firing a heater having a heater length multiplied by a heater width in a range less than 400 micrometers squared or for firing a heater with any variety of heater thickness. The particular claims having such limitations include the indicated-as-allowable claims 10 and 12. The Applicant has, however, amended the previous ranges "from about 0.007 to about 0.6 microjoules" to "from about 0.007 to about 0.176 microjoules." The specification provides support for these numbers as ranges expressly recited in Figures 10-12 for a micrometer squared limitation of 50 to 400, with a heater thickness of 500 to less than 1100 angstroms. While 1100 angstroms is not expressly recited in the Figures, straight-line interpolation of the heater entries of 400 μm^2/1000 angstroms and 400 μm^2/2000 angstroms leads a skilled artisan to the upper result of 0.176 microjoules.

The Applicant submits nothing in this Amendment constitutes new matter. For support, please see the ranges of limitations in Figures 10-12 and the specification at page 12, lines 8-11 where the Applicant states:

> "[w]hat was discovered was that stable performance, and thus an understanding of an appropriate heater energy per volume, occurred generally when the data points had higher heater energy per volume to the right of the "knee-bend" of the data points shown in the vicinity of data points 195."

At page 2, lines 11-14, the Applicant further states:

> [i]n one embodiment, the heater chip includes a heater having a length, width and thickness. The length

multiplied by the width (heater area) is in a range from about 50 to 500 micrometers squared while the thickness is in a range from about 500 to about 5000 or 6000 angstroms.

Accordingly, the Applicant submits that all pending claims are allowable over the prior art and respectfully requests notification of same. In the event, however, the Examiner disagrees or feels prosecution might be advanced with a telephonic interview, he is invited to call the undersigned representative.

Although no fees are believed due, the Applicant authorizes deduction of any necessary fees from Deposit Account 11-0978.

Respectfully submitted,

KING & SCHICKLI, PLLC

Michael T. Sanderson
Registration No. 43,082

KING AND SCHICKLI, PLLC
247 North Broadway
Lexington, KY 40507
Ph: (859) 252-0889
Fax: (859) 252-0779

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